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WHY CURES ARE NOT USED FOR CONTROL OF FOOT-AND-MOUTH DISEASE IN THE UNITED STATES 1/

Every time there is an outbreak of foot-and-mouth disease in or near the United States, many suggestions are made to the United States Department of Agriculture for curing or otherwise treating the diseased animals.

The use of a cure would be in direct contrast to the program the Department has always followed in combating outbreaks of the disease in this country. That program has always been eradication: Slaughter the diseased animal, destroy the infected carcass, clean up the premises, and free the country from the disease-causing virus.

There are two reasons why the Department has not adopted the "cure" approach in combating foot-and-mouth disease:

(1) No effective cure or treatment has ever been developed for foot-and-mouth disease.

(2) If an effective cure were developed, it would not eradicate the disease.

The objective of a "cure" approach is the recovery of the animal--not the destruction of the source of the disease. Even though a treated animal did recover, it would, during the period of treatment, continue to give off the disease-causing virus in large amounts and thus contribute to the spread of the disease. Any use of a "cure", therefore, would be an admission that the disease would recur and that we would try and live with it--the most infectious of all diseases affecting cattle.

The objective of an eradication program is to free the country completely from the disease. The Department believes that eradication, though it might appear drastic, is the most effective, efficient, and the least costly method of protecting our cattle industry from the ravages of foot-and-mouth disease.

1/ Information in this report was provided by the Animal Disease Eradication Branch and the Animal Disease and Parasite Research Branch, Agricultural Research Service.

Quarantine and Slaughter Effective in the United States

Congress enacted a strict quarantine law in 1930 prohibiting the importation of certain livestock and livestock products from countries where foot-and-mouth disease exists. Before the law was adopted, nine outbreaks of the disease occurred in the United States, the last in 1929. None has occurred since the law was enacted.

Three outbreaks appeared before the slaughter method was adopted in 1884. The 6 succeeding outbreaks were completely wiped out by a program of strict quarantine and slaughter of infected and exposed animals. Why this course of action was followed, instead of the use of curative-type treatments, is obvious in the light of present knowledge regarding the prevention, control, or eradication of foot-and-mouth disease. The essential facts are as follows:

1. A filtrable virus causes the disease which affects chiefly cloven-footed animals (cattle, swine, sheep, and goats). A common characteristic of the disease is that it is highly contagious in the early stages. When the first visible symptoms appear, the victim already is giving off infective virus at an enormous rate through body secretions and excretions.

2. Once established, foot-and-mouth disease spreads rapidly with devastating effects. In the mild form of the disease, 5 percent of the infected animals may die from the disease. Most of the deaths are among young animals. In the more virulent type, death losses may reach 30 to 50 percent of the infected animals. Others seemingly recover but are left in an impaired and unproductive condition. If, through inadequate eradication measures, foot-and-mouth disease were to become established in the United States, its presence probably would exact a toll of much more than $200,000,000 a year from the livestock industry, through decreased yields of meat, milk, and other products. The result would have a negative effect on the American standard of living.

3. Strict prohibition of imports of ruminants and swine from infected countries, slaughter of infected and exposed animals, and strict quarantine of infected premises have been effective in keeping our country free of foot-and-mouth disease. In successfully eradicating foot-and-mouth disease in the United States, Federal and State governments have joined forces to pay a fair indemnity for condemned animals based on their appraised value. This practice is widely accepted as being in the public interest because such a program expedites slaughtering of affected animals and thereby reduces the chance for further spread of infection. This plan enables the livestock owner to restock later with healthy animals. It can be operated with a relatively low cost to public funds, particularly when compared to the cost of living with the disease. The previous nine outbreaks have been brought under control at an average cost of less than $4,000,000.

Experience both here and in other countries shows that the value of effective plans for prevention or eradication overshadows search for cures in combating many serious infectious diseases of animals. By well-planned programs Australia, New Zealand, and Hawaii have kept their countries free of rabies; Brazil rid itself of rinderpest, a serious disease of cattle; and the United States eliminated outbreaks of foot-and-mouth disease and pleuropneumonia, and has virtually eradicated cattle-tick fever. In none of these successful programs has a cure or remedy been involved.

Use of Vaccines

4. Vaccination against foot-and-mouth disease is used by some countries where the aim is to control the infection rather than eradicate it. At best, vaccines are considered useful only when the infection spreads so widely that quick eradication is out of the question. Vaccines provide some immunity, but just how much, how long it lasts, and what degree of exposure it can withstand are still subjects for further research. Vaccination against one type of the foot-and-mouth disease virus does not provide immunity against any other type of which 6 have been identified. In Europe, where vaccination is used, vaccines have to be changed frequently when the virus type changes, and this has happened several times during a single outbreak.

Vaccination was used in Mexico during the most virulent phases of the outbreaks in 1947-52 and 1953-54. In the earlier outbreak vaccination was added to other eradication measures because the disease had become so widespread that full-scale eradication by slaughter of all infected and exposed animals threatened to upset the economy of the country. In the later outbreak a very limited amount of vaccine was used at the request of the Mexican government. In both cases, slaughter of infected and exposed animals was relied upon as the means of eradicating the disease.

The use of vaccines merely adds to the expense of operations and prolongs the campaign. When vaccine is used, those fighting the disease are never sure whether the infection is actually wiped out or merely masked by some unknown degree of immunity. In Mexico, vaccination had to be stopped and immunity allowed to expire before a determination could be made that the disease had been eradicated. Actually, the infection cropped up several times thereafter, and was handled by the usual eradication methods.

Disease is Constant Danger to United States Livestock

As long as the infection exists in any other country, the danger of spread of the disease to this country remains a constant menace. Realizing this danger, Congress in 1948 approved the conduct of research on foot-and-mouth disease in a laboratory, especially designed to prevent escape of the virus, provided the laboratory was established on a coastal island surrounded by navigable water and not connected to the mainland by a tunnel.

Funds were appropriated in 1952 for the construction of a research laboratory on Plum Island, which is located off the northeastern tip of Long Island, N.Y. In consultation with a foot-and-mouth disease research advisory committee, the Department developed plans for a laboratory structure and related facilities with meticulous safety features. Construction is scheduled for completion about January 1, 1956. Research work, however, was begun on Plum Island, now known as the Plum Island Animal Disease Laboratory, in August 1954--nearly 2 years ahead of schedule.

The advance in the timetable of research operations on Plum Island was made possible by the fact that the Chemical Corps of the U.S. Army turned over to the Department of Agriculture a rehabilitated building originally built for defense purposes. In these facilities the laboratory was able to enter at once upon a trial-run research project of vesicular stomatitis, one of the diseases that cannot under usual circumstances be differentiated from foot-and-mouth disease except by biological and laboratory analysis. Initial studies with the foot-and-mouth disease virus are expected to begin within a few months.

The Plum Island Animal Disease Laboratory will have essentially two programs--research and service. On the research side, the laboratory will conduct an 8-point program on foot-and-mouth disease and on such other exotic diseases as may require investigation. On the service side, it will provide diagnostic facilities for rapid and positive identification of the causes of disease outbreaks, plus facilities to supplement and support animal-disease control programs.

p. 2

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Questions and Answers on Foot-and-Mouth Disease

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UNITED STATES DEPARTMENT OF AGRICULTURE

Information in this report was provided by the Animal Disease and Parasite Research Branch, the Animal Disease Eradication Branch, and the Animal Inspection and Quarantine Branch, Agricultural Research Service.

QUESTIONS AND ANSWERS ON FOOT-AND-MOUTH DISEASE

The Disease Itself

Q. What is foot-and-mouth disease?

A. A highly contagious vesicular disease (characterized by vesicles or blisters) affecting cloven-footed animals. Among farm animals are included cattle, swine, sheep, and goats; among wild animals, deer, buffalo, antelope, etc.

Q. Does it affect human beings?

A. Foot-and-mouth disease very rarely affects people; it is a livestock disease. Farmers who have handled infected animals need not fear for their health. Neither is meat or milk from infected animals known to be dangerous to humans. The danger from handling infected animals is that persons can carry the disease mechanically on their hands, shoes, or clothes to other susceptible animals. Meat and milk are dangerous for the same reason--spreading the disease to other animals.

Q. What causes it?

A. A filtrable virus (a virus so small it passes through the finest porcelain filters). There are at least 7 recognized types of foot-and-mouth disease virus, and variants within these types. The virus remains infective for many months under favorable circumstances. It can be killed by high temperatures and by some disinfectants, but may retain infectivity for years when frozen.

Q. How can you determine what type of virus is present?

A. Only by serological (blood) or other laboratory tests.

Q. What does the disease look like?

A. Visible symptoms appear first as blisters on such tissues as the tongue, lining of the mouth, around the top of the hoof and between the digits. In milk cows, the blisters may appear on the teats and udder. The blisters soon break, leaving a raw eroded surface. In cattle there is excessive salivation, causing the animal to drool. When the feet are affected, the animal limps painfully or lies down.

Q. How can you be sure an outbreak is foot-and-mouth disease?

A. Thorough diagnostic tests are made by men trained in differential diagnosis of vesicular diseases (differentiation between vesicular diseases with similar or identical visible symptoms, such as foot-and-mouth disease, vesicular exanthema, and vesicular stomatitis). The diagnosis is confirmed on the basis of scientific fact.

Incidence and Previous Experience

Q. What experience has the U.S. had with foot-and-mouth disease?

A. Nine outbreaks have occurred in this country: 1870, 1880, 1884, 1902, 1908, 1914, 1924 (twice), and 1929. The most widespread of these was the one in 1914 when the disease appeared in 22 States and the District of Columbia. In other outbreaks, the infection was confined to relatively small areas except in California in 1924-25. The U.S. government worked closely with Mexico to eradicate the disease there during the years 1947-52 and 1953-54. U.S. specialists were invited to observe the eradication program in Canada during the outbreak of 1952. Furthermore, U.S. scientists have worked and are working in a number of foreign laboratories on cooperative research programs on foot-and-mouth disease. Research on foot-and-mouth disease was started in the United States in 1955 at the Plum Island Animal Disease Laboratory.

Q. Where does it occur in other parts of the world?

A. It is widespread in Europe, Asia, Africa, and South America. The major livestock-producing countries free of the disease (as of July 1956)include Australia, Canada, Ireland, Mexico, New Zealand, and the United States.

Mortality and Economic Losses

Q. Does foot-and-mouth disease usually kill affected animals?

A. Mortality varies widely; generally it is less than 5 percent, occurring especially in young animals. More virulent forms have caused death losses of 30 to 50 percent of the affected animals.

Q. What are the main economic effects of the disease?

A. We can't afford to live with the disease because of the great damage that comes from loss in condition and permanent impairment such as loss of fertility. Recovered animals seldom regain production efficiency. Meat animals lose weight. (Sore mouths make it most difficult to eat, and many do not eat at all. Sore feet keep them from ranging to where feed is located. The latter is an especially important problem in range areas.) Dairy stock also lose condition rapidly and milk production often drops to almost nothing.

Q. What if the disease is a mild form?

A. It is just as important to eradicate mild forms of the disease as those that are more virulent. Often the disease does appear in mild form with atypical symptoms. Usually the disease gains in virulence as it spreads. For this reason we cannot afford to take any greater chances with mild forms than with virulent forms.

Q. How much will an outbreak cost?

A. There can be no definite answer until the extent and duration of an outbreak is determined. Direct costs of eradication can be accounted for as the work progresses in the form of indemnity payments and administrative costs. However, by far the greatest expense of an outbreak is in losses suffered as a result of loss of production, deaths, and interruptions to normal marketing, transportation, feeding, and

slaughtering processes. The 1929 outbreak--the last in this country--cost $574,170 in direct expenses alone. Indirect costs cannot be estimated. The eradication campaign in Mexico since 1947 resulted in a net cost to the U.S. government through August 1954 of about $133,500,000, expended in the U.S. and in Mexico. It has been estimated that if the disease ever became firmly established in the United States it could cost the country up to one-fourth of its production of meat and other animal products.

Eradication Measures

Q. What measures are taken to stop the spread of the disease?

A. Eradication measures are built around a 4-point program that has proved successful in past outbreaks in this country: (1) Quarantine, (2) inspection, (3) slaughter, and (4) disinfection and testing of premises by gradual restocking under supervision.

(1) Quarantine

Q. How are quarantines imposed?

A. Some are imposed by State livestock sanitary authorities and some by the Federal Government.

Q. What is the difference between the two kinds of quarantines?

A. State quarantines are imposed within State boundaries, on local premises, in counties, or other areas within a State. Federal quarantines control the movement of susceptible animals and products across State lines.

Q. Who enforces quarantines?

A. State quarantines are enforced by local authorities, such as city, county, or State police, or by special deputies hired by local authorities. Federal quarantines are enforced by Federal inspectors or State employees deputized to enforce Federal quarantines.

Q. Who determines the extent of quarantines?

A. State and Federal officials cooperate in determining their extent.

Q. On what basis is the extent determined?

A. Quarantines are set up first over a wide enough area to be reasonably sure the quarantine line is outside the spread of infection. This means the first quarantines cover a relatively large area. When the exact extent of the spread is determined, quarantined areas may be reduced or extended according to circumstances.

Q. What do quarantines do?

A. Quarantines are set up to confine infection and protect farmers from further spread of the disease, and are designed to help rid the area of the disease as soon as possible. They limit the movement of animals,

certain animal products and materials, and human beings in varying degrees, depending upon whether they affect an infected or exposed premise, quarantine zone, or buffer zone.

Q. How do quarantines affect exposed or infected premises?

A. Until infected and susceptible exposed animals are properly disposed of and disinfection has been completed, neither persons, vehicles, animals, nor products may move on or off exposed or infected premises without permission from proper authorities. Authorized persons may move on and off the premises only after disinfection under the supervision of proper officials. Deliveries may be made to the premises under supervision.

Q. Why is it necessary to impose such strict quarantines, even prohibiting the movement of human beings?

A. Because foot-and-mouth disease is one of the most contagious of all animal diseases. In addition to being spread through contaminated feed, livestock handling facilities, and the like, the infection can be spread mechanically by human beings carrying the virus on their clothing, shoes, or hands as they move from an infected premise to other farms with susceptible animals.

Q. How do quarantines affect the entire area?

A. No susceptible animals may move out of the quarantine area. Movement of persons or vehicles is subject to rigid restriction to prevent the spread of infection. Specified animal products and materials, such as meat, hay, and straw, may not move out of the quarantine area. All movement of animals is prohibited until thorough inspections have been made to determine the extent of the infection. After the determination has been made, animals may be moved under permit. Creameries, cheese factories, etc., are investigated and required to sterlize milk cans before returning them to farmers. Milk, skim milk, buttermilk and whey must be heated to a point assuring safety before they are permitted to leave the plants. These provisions are not necessary as a safeguard to human health, but as a protection against the further spread of the disease among livestock. The first quarantines are often strict until the exact area of infection and its seriousness can be determined. Quarantines can be relaxed as soon as it is safe to do so.

Q. How do quarantines affect buffer zones?

A. Buffer zones may be used in some areas where geographical and other considerations make it advisable. These buffer zones surround the quarantine zones as further protection against the spread of the disease. Animals and animal products may be moved within the buffer zone under restrictions. Movement of human beings and vehicles between the buffer zone and quarantine zone are under the same restrictions as from any other part of the country.

Q. Do quarantines affect the movement to market of farm products such as truck crops?

A. The whole quarantine system is so organized as to prevent any unnecessary delay in the movement of salable products not considered to be a means of transmitting the disease. However, no products may

be moved from infected and known exposed premises until released by proper authorities. Hay, straw, and other similar kinds of forage that may be considered to be contaminated cannot be moved anywhere within or from the quarantine zone. Other crops, such as fruits and vegetables, will be allowed to move to market as soon as preliminary inspections have determined the extent of the infection within the quarantine zone, and proper officials have authorized the movement.

Q. Can such products as wheat or corn be moved out of the quarantine zone?

A. Yes, as long as the movement meets requirements set by the proper quarantine officials.

Q. Can such deliveries as feed and fuel be made to farms where the disease exists?

A. Yes, but under supervision of proper officials.

(2) Inspection

Q. How is inspection carried out?

A. By qualified veterinarians and assistants who inspect susceptible animals to detect immediately any further spread of the disease.

(3) Slaughter

Q. How are slaughter operations carried out?

A. Infected and exposed animals usually are slaughtered and buried or burned on the home premises. Carcasses are buried deep enough to prevent scavenger animals from digging down to them and special measures are taken to exclude other animals from the area.

(4) Disinfection and Testing

Q. How are disinfection and testing carried out?

A. After slaughter operations are completed, contaminated premises are thoroughly cleaned and disinfected according to prescribed methods. Later, susceptible test animals are placed on the premises and repeatedly inspected for a period determined according to existing circumstances. If the test animals show no evidence of the disease at the end of the prescribed period, the premises are released from quarantine for restocking by the owner.

Treatment and Cures

Q. Why not treat and cure the disease rather than use the slaughter method?

A. There is no recognized cure for foot-and-mouth disease. Treatments can only alleviate the symptoms. They do not prevent the spread of

the virus and thus make eradication of the disease even more difficult. Experience has shown that in dealing with this most contagious of all animal diseases it is less costly to move in quickly with a slaughter program and wipe out the infection before it becomes firmly established. The slaughter of the few protects the many.

Q. Do all countries use the same measures to combat the disease?

A. No. In many countries of Europe, Asia, and South America, the disease has been established for so many years that a slaughter program is considered economically impractical. In the lesser developed of these countries, foot-and-mouth disease is allowed to run its course unchecked. Other countries attempt to control the disease and live with it. But all countries that eradicate the disease when it strikes do so by a slaughter and quarantine method similar to that used in the United States.

Use of Vaccines

Q. Is vaccination ever used against foot-and-mouth disease?

A. Yes, by some countries. But no country has ever eradicated the disease by vaccination alone. It is generally used only as a means of control.

Q. Have vaccines proved successful where they have been used?

A. It has been determined that vaccination against one virus type will not provide imunity against other types, In Europe, where vaccination is used, vaccines have had to be changed frequently when new types of virus have appeared several times during a single outbreak. Furthermore, the use of vaccines adds to the expense of operations and lengthens the effort if the disease is being eradicated. Disease fighters are never sure whether the infection is actually wiped out or whether vaccines have built up immunity that is masking the virus, lying ready to infect susceptible animals again and again. At best, vaccines are considered useful only when the infection spreads so widely that quick eradication is out of the question. Vaccines can develop a degree of immunity in susceptible animals, but how long the immunity can last and what degree of exposure it can withstand are still subjects for further research.

Q. Why was vaccination used during the outbreak in Mexico in 1947-52?

A. The disease got a secure foothold before adequate eradication measures were started. Even though limited to central Mexico, the disease became so widespread in the region that approximately 17,000,000 animals were involved, consequently full-scale eradication by slaughter threatened to upset the economic balance of the country. It was determined that vaccination should be added to the eradication measures in an effort to reduce the rapid spread of infection. At the same time, eradication of centers of infection by slaughter was continued as a vital part of the program.

Q. Will vaccination be used during an outbreak in the U. S.?

A. No. Not unless the infection gets out of control and spreads widely on a nationwide basis.

Q. If the disease did spread that widely, would vaccines be available?

A. Yes, within a reasonably short time after a decision was reached to use them. We do not produce such vaccines now, but we could do it quickly if necessary.

Indemnities

Q. Will farmers be paid for animals that are slaughtered?

A. Yes. After the Secretary of Agriculture declares a state of emergency because of the existence of foot-and-mouth disease, the Department invites the various affected States to cooperate in the control and eradication of the disease. When the authorities of a State agree to enforce proper quarantine and eradication measures, the Department joins with the State in sharing costs of indemnities and related expenses on a 50-50 basis.

Q. Who decides the value of condemned animals?

A. Appraisers representing State and Federal Governments, working jointly, appraise animals to be slaughtered according to market values as meat, dairy, or breeding animals.

Q. How will the owner be paid for highly valued breeding animals?

A. Appraisals are made on their real value as breeding animals. But payments to owners are limited to not more than three times the meat or dairy value of the animals.

Q. What about other losses sustained as a result of a campaign?

A. If condemned products and facilities such as hay, straw, and portions of livestock feeding and housing facilities must be destroyed, the owner may be paid for his loss.

Effect of the Outbreak on the Vicinity

Q. What can farmers do?

A. Infected farms will be under enforced quarantines, but other farmers should keep visitors off their premises. The farmer on noninfected premises should: (1) Prevent stray animals from coming in contact with his own livestock or into areas where they are kept. (2) Introduce new animals only on advice of veterinary and livestock sanitary officials. (3) Provide a means for deliveries of feed and other products under supervision of livestock sanitary authorities so that vehicles which might have been on other farms do not have to come on his premises, and particularly not into areas where his animals are kept. (4) Watch livestock carefully for symptoms resembling foot-and-mouth disease. (5) Refrain from visiting other premises where livestock are kept.

Q. What should a farmer do if he finds symptoms of foot-and-mouth disease?

A. Report the fact immediately to one of these: His regular practicing veterinarian, an area veterinarian employed by the State or Federal

government, the State veterinarian, or the United States Department of Agriculture veterinarian-in-charge in his State. Set up his own quarantine until the proper authorities arrive to take charge and make a proper diagnosis. Remain on premises, and do not call neighbors in to observe the condition of the livestock.

Q. What can residents of an urban community do to help in a campaign?

A. Don't travel in the quarantine zone unless absolutely necessary. Particularly, stay away from premises on which livestock are kept. Comply fully with disinfection and quarantine requirements. Don't repeat unconfirmed rumors. Reliable information will be released periodically by State and Federal Departments of Agriculture.

Q. Will a community suffer food shortages because of the disease or quarantines?

A. No. Quarantines do not ordinarily interfere seriously with supplies of milk, meat, and other foods. There is no reason to expect food shortages, unless the disease becomes widespread.

Q. How long will quarantines be in effect?

A. That depends on how long the infection persists. Quarantines will remain in effect until it can be determined that the disease has been eradicated. All restrictions will be removed as soon as it is safe to do so.

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